EXPRESS MAIL LABEL NO.
ER456266005 US

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants: Suekane et al.

Title: Magnetic Recording Medium

Serial No.: Unknown Filing Date: Herewith

Examiner: Unknown Art Unit: Unknown

Docket No.: AK2-C2

Mail Stop Patent Application
P.O. Box 1450
Alexandria, VA 22313-1450

Declaration of Dr. Christopher H. Bajorek

I, Dr. Christopher H. Bajorek, declare:

1. I am the same Dr. Christopher H. Bajorek who submitted declarations in parent patent application 09/895,679. I reaffirm that the statements in those declarations are true and correct.

2. During prosecution of the parent '679 application, the Examiner alleged that the limitation "antiferromagnetic coupling" was not supported by the specification. See the Office Action dated April 16, 2003. For reasons set forth in my earlier declarations, antiferromagnetic coupling is inherent in a recording medium comprising two magnetic Co alloy layers separated by a Ru intermediate layer having a thickness from 3 to less than 10Å thick.

3. In an advisory action in the '679 application, the Examiner questioned whether antiferromagnetic coupling was inherent in the claimed structure

> on the grounds that *the antiferromagnetic coupling* of the film disclosed by Carey et al. (the film being substantially the same as that claimed by Applicant) is overcome for large applied fields and the moments of the magnetic films are actually parallel to one another. Thus, the presence of antiferromagnetic coupling is clearly a more complicated phenomenon based on the materials and thicknesses of the layers but also the strength of the applied field as a result of the values of H_{ex2} and H_{c2}.

Advisory Action dated 11/17/03, page 2, emphasis in original. This statement is incorrect for the following reasons.

4. A magnetic disk 1 in accordance with the present invention comprises a substrate 3, an underlayer 4, a first Co alloy layer 5, a Ru interlayer 6 and a second Co alloy layer 7 (Fig. A attached hereto). During writing, a write element E on a read-write head H applies a write field F that overcomes a) the magnetic coercivities[1] of the Co alloy layers; and b) any antiferromagnetic coupling between layers 5 and 7, and forces the magnetization direction to be parallel to the write field. The write field is applied to a point on the disk only for a very brief time, e.g. 5 nanoseconds in a magnetic disk drive. Thereafter, the write field at that point falls to zero. (During use, a magnetic disk rapidly spins, and the point being written to rapidly moves away from the read-write head.)

5. The fact that for about 5 nanoseconds the write field overpowers the magnetic coercivities of layers 5 and 7 and any antiferromagnetic coupling therebetween has nothing to do with whether or not antiferromagnetic coupling exists. First, during the vast majority of the time that the drive operates, the applied magnetic field is zero, and has no impact on the operation of the magnetic disk.

6. Second, the "large applied field" (i.e. the write field) alluded to by the Examiner overpowers the coercivity of the magnetic layers and antiferromagnetic coupling of the magnetic layers regardless of whether antiferromagnetic coupling exists. This overpowering exists regardless of whether or not there is antiferromagnetic coupling. In other words, this effect has nothing to do with whether antiferromagnetic coupling exists.

7. To draw an analogy, when NASA launches a rocket, the rocket engines overpower gravity. The fact that the rocket engines overpower gravity does not mean that gravity ceases to exist. Rather, it means that gravity is overcome. In like manner, the mere fact that the write field overcomes the magnetic layers' coercivity and the antiferromagnetic coupling does not mean that the coercivity and coupling do not exist. Rather, it means that they are overcome.

8. During prosecution of the '679 application, the Examiner contended that Carey col. 6, lines 21-28 implied that antiferromagnetic coupling was not inherent in Applicants' claimed structure. In particular, the Examiner referred to the following sentence from Carey: "Thus, the magnetic properties and thickness of the bottom film, as well as the AF-coupling film, must be designed to maintain $H_{ex2}>H_{c2}$." See Response to Office Action and Interview Summary dated 9/9/03. In the declaration filed therewith, I explained that this passage pertained to the conditions for antiferromagnetic switching, and **not** antiferromagnetic coupling. Antiferromagnetic coupling exists even if H_{ex2} (the antiferromagnetic exchange field) is not greater than H_{c2} (the coercivity of the bottom magnetic film). The fact that H_{ex2} exists at all suffices to show that antiferromagnetic

[1] Coercivity is the force that causes the magnetic layer to tend to keep its currently existing magnetization state. Without coercivity, a magnetic recording medium would lose all its data. The write field is the means by which one changes the magnetization state of the medium to write new data. The write field overpowers the coercivity during writing.

coupling exists. H_{ex2} is the antiferromagnetic coupling force. The condition $H_{ex2}>H_{c2}$ is merely Carey's way of stating that he thinks the antiferromagnetic coupling force (H_{ex2}) must be greater than the lower film coercivity (H_{c2}) to cause switching. Carey is not suggesting that this condition must be met for antiferromagnetic coupling to exist.

9. In my above-mentioned declaration, I reaffirmed that antiferromagnetic coupling was inherent in the structure disclosed in the '679 application.

10. I have read and understand claims 17-23 of the present application. Claim 17 recites: "said interlayer causes an antiferromagnetic exchange field H_{ex} exerted by the upper ferromagnetic metallic layer on the lower ferromagnetic metallic layer." This phenomenon is inherent for a magnetic disk comprising first and second ferromagnetic metallic films comprising a cobalt alloy separated by an Ru interlayer having a thickness from 3 to less than 10Å thick. This can be seen in exhibit B of my declaration dated 2/3/03. In particular, the "bumps" in the hysteresis curves of exhibit B reflect the point at which the lower magnetic layer switches direction. This occurs because the upper layer exerts an antiferromagnetic force H_{ex} on the lower layer, thereby causing the layer to switch directions. If there were no such antiferromagnetic force, the lower layer would not switch directions, and there would be no such bump.

11. Carey states "the magnetic properties and thickness of the bottom film, as well as the AF-coupling film, must be designed to maintain $H_{ex2}>H_{c2}$." Col. 6, lines 26-28. This equation says nothing about the conditions needed in order for the antiferromagnetic exchange field H_{ex} to exist. Rather, it only purports describe to the conditions needed for the antiferromagnetic exchange field to switch the magnetization direction of the lower layer. In short, Carey does not contradict paragraphs 10 and 11 of this declaration.

12. Carey states $H_{ex2}=J_{ex}/M_2t_2$. Col. 6, line 17. H_{ex2} is the antiferromagnetic exchange field exerted on the bottom magnetic layer. Carey explains that J_{ex} is the antiferromagnetic interface exchange energy density across the Ru spacer layer, M_2 is the magnetization of the lower magnetic layer and t_2 is the thickness of the lower magnetic layer. The existence of J_{ex} is inherent for a magnetic disk comprising first and second ferromagnetic metallic layers comprising cobalt separated by an Ru interlayer having a thickness from 3 to less than 10Å thick. It gives rise to the existence of the antiferromagnetic exchange field H_{ex}, which in turn is manifested by the above-mentioned bumps in Exhibit B of my 2/3/03 Declaration. There is nothing in Carey that contradicts this fact.

13. Claim 21 recites: "said interlayer causes an antiferromagnetic interface exchange energy density J_{ex}." This limitation is inherent in the structure disclosed in the application for the reasons set forth in paragraph 12 above.

14. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements are made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Respectfully submitted,

Christopher H. Bajorek

3/22/04

Date

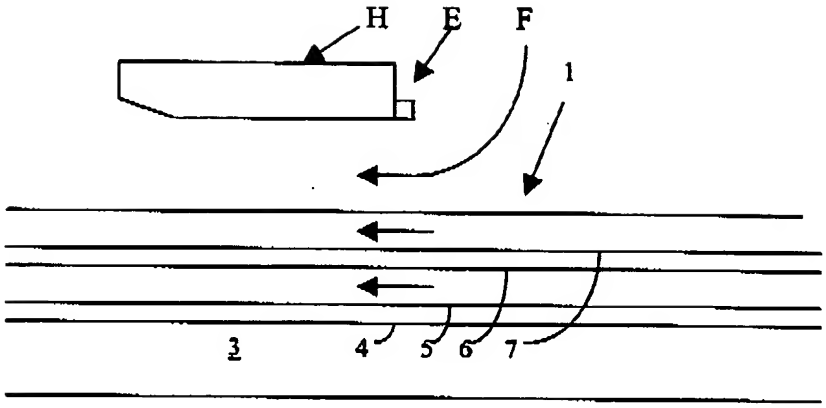

FIGURE A